Meditation, Mindfulness, and Cognitive Flexibility

A Departmental Honors Thesis (PSYS 499)

By

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Abstract

The present study aimed to examine the proposed relationship between meditation, mindfulness, and cognitive flexibility. This study surveyed 141 participants recruited from reddit, facebook, and an email sent through Ball State University's Communication Department to students. Participants filled out a survey in which they were asked questions related to previous meditation experience, everyday mindfulness, and cognitive flexibility. It was hypothesized that (1) daily meditators would score higher on the mindfulness inventory than those classified as non-meditators, (2) those who meditate daily will score higher on the cognitive flexibility scale, and (3) there will be a positive correlation between participant reported mindfulness and reported cognitive flexibility.

keywords: meditation, mindfulness, cognitive flexibility,

Acknowledgments

I would like to thank Dr. Holtgraves for advising me and guiding me through the finer points of this project… and the perils of SPSS.

I would like to thank Dr. Berg for teaching me about meditation, Eastern philosophy, and inspiring this project.

I would like to thank Kim Taylor for taking me under her wing from the start of my time at Ball State. Thank you for believing in me, advising me, and always pushing me to succeed.

Process Analysis Statement

I took Dr. Berg's HONR 189 course on Eastern philosophy with the hope that it would help to round out the knowledge of Western philosophy I had gained through my other honors courses. I always hoped that the course would bring me new perspectives and ideas, and show me alternative ways of seeing the world. I knew the course would challenge me in many ways. However, I had no idea that Dr. Berg and his course would inspire me to take a hard look at my life… and eventually inspire the most important project of my undergraduate career.

It was in this class that I was formally introduced to the concept of meditation and its spiritual significance in many Eastern cultures. I devoured every text and poem I came across. I found the whole concept behind meditational practice to be refreshing, especially as a psychology major. I began to do some light research and practiced on my own about once a week. As a person who had been recently diagnosed with an anxiety disorder, this helped tremendously in my own self-care.

I continued my research, and began looking into integrating meditation into my professional field of school counseling. There are mountains of research out there suggesting the benefits of meditation for children. I became very interested in learning how to teach meditation, especially as a form of therapy for children in schools. I decided to do this thesis, in hopes of getting my feet wet in this field. I wanted to really dig deep into the research and start conducting a study of my own. My goal is to one day, start a meditation program wherever my career as a counselor takes me. This thesis is my first step toward that dream.

This was my first time conducting any research – let alone conducting an entire study almost completely on my own. Learning and interpreting SPSS was particularly challenging for

me, but my advisor Dr. Holtgraves walked me through every step. I still have a lot to learn, but I have come so far in the last year of putting this project together.

Most importantly, I proved to myself that I am capable of so much more than I ever imagined. I spent many long nights tweaking and typing and troubleshooting. I fried my brain pouring over literature, spreadsheets, and raw data. But this mountain of a project is finally complete. It may just look like a boring thirty-page research paper to most, but to me, this stack of ink and pulp has a heartbeat. This thing has a life of its own now, and I am a better scholar, professional, and person for it.

Meditation, Mindfulness, and Cognitive Flexibility

Originating 3,000 years ago as an elemental practice of Buddhism, meditation is a mental exercise for the purpose of reaching a state of tranquility, awareness, or spiritual peace. As the practice has spread from its Eastern cradle, it has undergone many transformations and rebirths. In a study done by Cramer et al. (2016), modern meditation in the United States was found to be mainly used for general wellness, improving energy, aiding memory or concentration, and reducing anxiety, stress, and depression.

Substantial literature has linked meditational practice to a multitude of health benefits. Meditation is a complex neurocognitive task that has the power to alter brain structure and function (Newberg, Wintering, Khalsa, Roggenkamp, & Waldman, 2010; Moore & Malinowski 2009). It is a practice that has shown to improve conditions such as hypertension, insomnia, irritable bowel syndrome, PMS, and epilepsy (Cramer et al., 2016). Meditative practice has also been linked to valuable psychological benefits such as stronger concentration, greater tolerance of change or turmoil, and heightened sensory awareness (De Silva, 1990). Newberg et al. (2010) conducted a preliminary study that found meditation improved cognition in Alzheimer's patients with memory loss. With these well-researched benefits in mind, the purpose of the current study is to investigate the potential correlation between meditation, mindfulness, and cognitive flexibility.

Mindfulness

Mindfulness is a non-judgmental, accepting awareness of moment-by-moment experience (Wimmer, Bellingrath, & Von Stockhausen, 2016). It is a state of sensory awake-ness or alertness to one's surroundings and perceptions, and it carries a warm and open disposition. Mindfulness is a natural state for some, but anyone can cultivate it through practice (Walach,

Buchheld, Buttenmuller, Kleinknecht, Schmidt, 2006). For example, in their 2009 study, Moore and Malinowski found that frequent meditation correlated with higher levels of self-reported mindfulness. Whether this indicates that meditation increases mindfulness, or that those who meditate are inherently more mindful has yet to be determined.

While meditation itself is the most popular method of cultivating mindfulness, it is not the only way. One of the most popular programs used to develop mindfulness is known as Mindfulness-Based Stress Reduction (MSBR; Kabat-Zinn, 1990). The MSBR consists of eight weekly group meetings featuring mindfulness training exercises like mindful yoga, body scanning, and meditation (Hölzel et al., 2011). Hölzel et al. (2011) used the MSBR in a controlled longitudinal study. Their findings suggested that participation in the MSBR was associated with increased gray matter density in areas of the brain associated with learning, memory, emotional regulation, and perspective taking. A year before, Hölzel et al. (2010) conducted a similar study that found prolonged mindfulness-based stress intervention not only change the function of the amygdala, but also its structure. This resulted in lower perceived stress and anxiety levels among participants. These findings are important because they show that mindfulness independent of meditation can provide psychological health benefits.

Measuring Mindfulness

There are many existing ways to measure mindfulness itself. The Mindfulness and Attentional Awareness Scale (MAAS) (Brown & Ryan, 2003), Toronto Mindfulness Scale (Bishop et al., 2003), and the Kentucky Inventory of Mindfulness Scale (KIMS) (Baer, Smith, & Allen, 2004) are all valid measures used to quantify mindfulness. Each of the aforementioned scales, however, has problematic facets. The MAAS focuses on attentional awareness and ignores the accepting, open qualities of mindfulness. The Toronto Mindfulness Scale

unfortunately does not account for participant differences in meditation experience, and the KIMS ignores some aspects of mindfulness and was tested only on a sample of non-meditators. Mindfulness can be seen as a target variable in clinical intervention, as a moderating variable, and as a personality trait (Walach et al., 2006), and The Freiburg Mindfulness Inventory was created to incorporate and measure all these qualities.

The Freiburg Mindfulness Inventory (FMI) was developed by Buchheld, Grossman, and Walach in 2001. It exists both long and short formats. In general contexts, where participants may not have any knowledge of the Buddhism or mindfulness meditation, the short form is most suitable. This short form consists of 14 questions scored on a four-point Likert scale. Walach et al. conducted a 2006 validation study of the Freiburg Mindfulness Inventory, which reaffirmed its reliability (Cronbach's alpha = .93/.94).

Cognitive Flexibility

Cognitive flexibility is the measure of an individual's ability to problem solve and think creatively. Muller, Langer, Cieslik, Rottschy, and Eichoff (2013) describe it as an essential aspect of executive functioning. When a situation changes, the cognitive system can adapt, switch attention, choose information, decide on a necessary response, and form plans, all in a matter of seconds (Varanda & Fernandes, 2017). Cognitive flexibility is required for this quick shifting between tasks.

Because cognitive flexibility is key in quick-shifting cognitive functions, it also plays a fundamental role in the development and proficiency of language (Varanda & Fernandes, 2017). In their 2017 study, Varanda and Fernandes investigated cognitive flexibility among children with autism. They found that cognitive flexibility training helped individuals develop social interaction skills, and that cognitive flexibility training offered an alternative to more traditional

cognitive rehabilitation programs.

Cognitive flexibility also is paramount in creative thinking. Ritter, Kuhn, Muller, Baaren, Brass, and Dijksterhuis (2014) conducted a study that showed participants one of two videos. One video showed a woman making a sandwich in a schematically normative way. Another video showed a woman making a sandwich in a schematically abnormal way. They found that found that when participants had schemas violated, their cognitive flexibility was enhanced. Those participants with higher cognitive flexibility were found to generate significantly more ideas and demonstrated greater creative thinking than those with lower cognitive flexibility.

Ultimately, cognitive flexibility cannot be understood as a singular ability but as a unified interaction of several cognitive mechanisms. This unified interaction of cognitive mechanisms responds to environmental changes in order to achieve flexible behavior - such as solving a problem in a new way (Varanda & Fernandes, 2017).

Measuring Cognitive Flexibility

Cognitive flexibility has historically been measured using neuropsychological tests designed to evaluate a person's level of cognitive rigidity, or inability to think creatively or flexibly (Johnco, Wuthrich, & Rapee 2014). It is also commonly measured using tests that require switching between different tasks (Armbruster, Ueltzhöffer, Basten, & Fiebach, 2012). Such instruments include performance-based measures like the Stroop task, trail making tests, and card sorting tests. More recently, self-report measures have become more popular to measure cognitive flexibility because of their straightforward and easy-to-deliver nature. Several self-report measures exist, including The Cognitive Flexibility Index (CFI; Dennis & Vander Wal, 2010), which is a 20-item measure, with high validity and internal consistency. The CFI is a reliably survey but there has not been much follow-up research to put it to the test.

One of the oldest and most popular self report scales is the Cognitive Flexibility Scale. The Cognitive Flexibility Scale (CFS) was created by Martin and Rubin in 1995. It exists as a 12-item 6-point Likert scale, designed to measure three components of cognitive flexibility. These components are described by Martin and Rubin (1995) as "a person's (a) awareness that in any given situation there are options and alternatives, (b) willingness to be flexible and adapt to the situation, and (c) self-efficacy in being flexible." Cognitive flexibility, in these areas, is considered to be an essential component of interpersonal communication competence and has been shown to be associated with communication assertiveness and responsiveness (Dennis & Vander Wal, 2010). Based on the theory underlying the CFS, individuals competent in their interpersonal communication are more likely to be successful in achieving their personal goals. Their findings showed significant internal reliability (a = .76–.77) and high test–retest reliability (.83) for the CFS (Martin & Rubin, 1995).

Linking Meditation, Mindfulness, and Cognitive Flexibility

Existing research regarding mindfulness, meditation, and cognitive flexibility has created a strong foundation for the current study to build upon. In 2009, Moore and Malinowski studied attentional control and mindfulness between meditators and non-meditators using Stroop tasks. They expected to find higher self-reported mindfulness in the meditation group and a positive correlation between mindfulness and the different measures of attentional performance and cognitive control. Moore and Malinowski found that meditators performed significantly better than non-meditators on all measures of attention, and self-reported mindfulness was higher in meditators than non-meditators. Correlations between mindfulness and all attention measures were significant.

Moore (2013) sought to investigate the concept of *flow* (a "state of enthrallment and ordered consciousness") and its relation to cognitive flexibility and mindfulness. Specifically, he hypothesized that mindfulness would positively correlate with flow disposition. Moore used the CFS, Cognitive and Affective Mindfulness Scale-Revised (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007), and Dispositional Flow Scale-2 General (Jackson & Eklund 2002). He found that cognitive flexibility and mindfulness were significant predictors of flow.

Muller, Gerasimova, and Ritter (2016) conducted a study in which, two groups of experienced meditators performed a meditation session. Participants' creativity and cognitive flexibility were assessed before and after the meditation session. Their findings suggested that meditation increased creative performance.

Lin (2014) conducted a study that found that a positive emotional state promoted greater cognitive flexibility among participants. This is important because it shows that cognitive flexibility can be improved with dispositional changes. This leaves room for the possibility that mediation could bring about these dispositional changes, allowing for greater cognitive flexibility.

The Current Study

The current study intended to place itself in dialogue with the aforementioned research regarding meditation, mindfulness, and cognitive flexibility. Moore and Malinowski (2009) found strong correlations between meditational practice and self-reported mindfulness. Moore (2013) found that cognitive flexibility and mindfulness were positively correlated. Muller et al. (2016) and Lin (2014) both conducted studies that suggested that meditation and positive emotional states have the potential to increase cognitive flexibility.

With this foundation of research in mind, the current study hoped to link these ideas together in new ways, and discover the ways in which meditation, mindfulness, and cognitive flexibility are interrelated. Specifically, I hypothesized that: (1) daily meditators would score higher on the mindfulness inventory than those classified as non-meditators, (2) those who meditate daily will score higher on the cognitive flexibility scale, and (3) there will be a positive correlation between participant reported mindfulness and reported cognitive flexibility.

Method

Participants

Participants included 141 people, ages 18 to 83 years. Fifty-five were male, 85 were female, and 1 identified as "other." 87.2% were white, 3.5% black, 0.7% Asian, 2.1 % Hispanic/Latinx, 0% Native American/ Pacific Islander, 6.4% multiracial, and 0% identified as other. When asked about the highest degree they had achieved, 28.4% had completed a high school diploma or equivalency (GED), 14.2% Associate's degree (junior college), 32.6% Bachelor's degree, 14.9% Master's degree, 7.8% Doctorate or Professional degree (MD, JD, DDS, etc.), 0% Other, and 2.1% None of the above (less than high school). Participants were recruited via the Ball State University Communication Center email list, Reddit.com, and Facebook posts (Appendix F). No incentives were given.

Materials

The current study used an online survey through Qualtrics in order to collect data. The survey included informed consent (Appendix A.) and demographic questions (Appendix B). Participants then were directed to a meditation questionnaire, found in Appendix C.

Freiburg Mindfulness Inventory (FMI). The FMI has a total of 14 items, which measure personal experience of mindfulness. It was developed by Buchheld, Grossman, and

Walach in 2001. One example item is "I feel connected to my experience in the here-and-now." The FMI uses a four-point Likert scale (*1=Rarely to 4=Almost Always).* The FMI has been found to have significant reliability (Cronbach's alpha = .93/.94). See Appendix D for the full survey.

Cognitive Flexibility Scale (CFS). The CFS has a total of 12 items, which assess personal beliefs and feelings about individual behavior related to cognitive flexibility. It was developed by Martin and Rubin in 1995. One example item is "I can communicate an idea in many different ways." The CFS uses a six-point Likert scale (*1=Strongly Disagree to 6=Strongly Agree*). The CFS has been found to have significant internal reliability (a = .76–.77) and high test–retest reliability (.83) See Appendix E for the full survey.

Procedure

The current study used an online survey through Qualtrics in order to collect data. The survey began with informed consent (Appendix A.) and demographic information (Appendix B). Participants were required to be 18 years of age or older to complete this survey. The "skip logic" function in Qualtrics was used to send participants to the end of the survey if they were 17 years old or younger.

Following this, participants were then directed to a meditation questionnaire, found in Appendix C. The current study used counterbalanced survey presentation. Counterbalancing offsets the power of variables on one another by exposing participants to two or more ordered effects. In the current study, the CFS, FMI, and Meditation Questionnaire were presented in counterbalanced order after the meditation survey, to prevent any test from affecting the others.

Results

Preliminary Analysis

Exclusion of Data. Participants were excluded from this data set if they had not completed more than 25% of the survey, or if their elapsed survey time was under 3 minutes. Participants were automatically excluded from taking the survey if they were under 18 years of age.

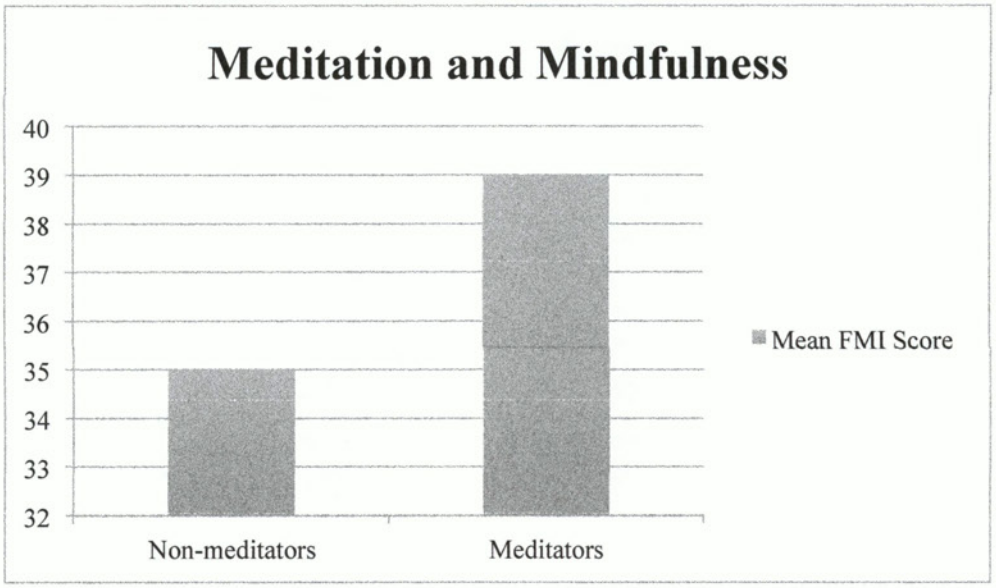
Descriptive Statistics. The Freiburg Mindfulness Scale (FMI) was shown to be significantly reliable with a Chronbach's alpha of .87 (N = 141). The calculated average score of the measure was $M = 35.67$ (SD =7.23). The Cognitive flexibility scale (CFS) was also significantly reliable with a Chronbach's alpha of .83 (N = 141). The calculated average score of the measure was $M = 56.03$ ($SD = 7.71$).

Hypothesis Tests / Research Questions

The current study hypothesized that (1) daily meditators would score higher on the mindfulness inventory than those classified as non-meditators, (2) those who meditate daily would score higher on the cognitive flexibility scale, and (3) there would be a positive correlation between participant reported mindfulness and reported cognitive flexibility.

Hypothesis 1. To test to see if there was a relationship between daily meditation and mindfulness, mindfulness was analyzed using a one-way ANOVA. The results showed a significant positive relationship between mindfulness and daily meditation, $F(1, 131) = 5.71$, $p < .05$. This means that those who meditate daily scored significantly higher on the FMI than those who were not classified as meditators. Figure 1 provides a summary of these results.

Figure 1



Hypothesis 2. To test if there was a relationship between daily meditation and cognitive flexibility, cognitive flexibility was analyzed as a function of mediation activity using a one-way ANOVA. The results showed no significant relationship between cognitive flexibility and daily meditation. $F(1, 130) = 0.69$, $p < .05$. This means that those who meditate did not score more highly on the CFS than those classified as non-meditators.

Hypothesis 3. To see if there was a significant positive relationship between mindfulness and cognitive flexibility, Pearson's correlation coefficient was computed. These results indicate that there was a significant negative relationship between mindfulness and cognitive flexibility, r ($N = 133$) = -.369, $p < .01$. This means that those who scored highly on the FMI survey, were significantly more likely to score lowly on the CFS, and vice versa.

Exploratory analyses

Supplementary analyses were run to determine any extraneous relationships between the surveyed variables. To see if there was a significant relationship between gender and cognitive

flexibility, cognitive flexibility was analyzed using a one-way ANOVA with gender as the independent variable. The results showed a significant relationship between gender and cognitive flexibility, $F(1, 127) = 2.10, p < .05$. These results indicated that males were significantly more likely to score highly on the CFS (M=55.96) than females (M=54.04). Additionally, to see if there were any existing correlations between age and mindfulness, a Pearson's correlation coefficient of r (N=134) = .219, $p < .01$ was calculated. Likewise a Pearson's correlation coefficient of r (N=136) = .246, $p < .01$ was calculated to determine any existing relationships between age and cognitive flexibility. These results suggest that both mindfulness and cognitive flexibility scores improved increased with age among the current study's participants.

Discussion

Previous research suggested that relationships exist between meditation, mindfulness, and cognitive flexibility. Moore and Malinowski (2009) found strong correlations between meditational practice and self-reported mindfulness. Moore (2013) found that cognitive flexibility and mindfulness were positively correlated. Muller et al. (2016) and Lin (2014) both conducted studies that suggested that meditation and positive emotional states have the potential to increase cognitive flexibility.

The current study hypothesized that: (1) meditators would score higher on the mindfulness inventory than non-meditators, (2) those who meditate will score higher on the cognitive flexibility scale, and (3) there will be a positive correlation between participant reported mindfulness and reported cognitive flexibility. These hypotheses were only partially supported.

Hypothesis (1) was supported. The current study found that a statistically significant relationship between meditation and reported mindfulness existed. This implies that either meditators become more mindful with daily meditation practice, or the mindful are naturally drawn to meditation. Hypothesis (2) was not supported. No significant relationship between meditation and reported cognitive flexibility was found. This indicates that either meditation does not enhance cognitive flexibility, or more research is necessary to firmly establish the previously suggested relationship. Hypothesis (3) was not supported. A statistically significant *inverse* relationship was found between mindfulness and cognitive flexibility. This suggests that somehow, increased cognitive flexibility lowers one's ability to be naturally mindful. This finding seems to be counterintuitive, but the CFS was shown to be significantly valid with a Chronbach's alpha of .83 (N = 141). This finding may be due to a small homogenous sample size, pulling participants primarily from social media, or the way researchers split the variable into "daily meditators" versus "non-meditators" instead of making meditation practice a continuous variable. Either way, this curious finding suggests that more research is needed to determine the nature of the relationship between mindfulness and cognitive flexibility.

Strengths and Limitations

The present study aimed to fill in research gaps in the growing field of study regarding meditation and mindfulness. Few studies have attempted to link meditation, mindfulness, and cognitive flexibility – and none have done so using entirely self-report scales (versus Stroop tasks). The current study added to this body of research, validated the FMI and CFS scales, and indicated that mindfulness and meditation are related. This study featured strong experimental design, with counterbalanced surveys to account for survey presentation bias.

The present study also had limitations that should be considered in future related research. The small sample size and lack of diversity may have affected results, causing them to not be generalizable to the population as a whole. The study may have suffered from participant self-selection bias, causing the results to be skewed in favor of meditators. The meditation questionnaire and split of participants into only "Daily Meditator" and "Non-Meditator" categories may also have affected results.

Implications for Future Research

To improve upon this study for future research, a broader sample size and more diverse population should be surveyed. Researchers should consider splitting up their meditation variable groups based on meditation practice in general, not just daily meditation. Researchers may even consider making meditation a continuous variable. It may also prove valuable to conduct a longitudinal study on the effects of meditation on mindfulness and cognitive flexibility in the future.

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Appendix A.

Informed Consent

Project Title

Meditation, Mindfulness, and Cognitive Flexibility

Principal Investigator

Audra L. Butler, Ball State University, Fourth-Year Student in B.A. in Psychological Sciences.

Study Purpose and Rationale

The purpose of this study is to examine the relationship between meditation, mindfulness, and cognitive flexibility.

Inclusion/Exclusion Criteria

To be eligible to participate in this study, participants must be age 18 or older.

Participation Procedures and Duration

For this project, participants will complete a survey, which will involve several components. Participants will first be asked to provide demographic information. They will then be asked Data collection will remain anonymous. The survey will take about 30 minutes to complete.

Data Anonymity

Data collection will remain strictly anonymous, meaning that researchers will not be able to connect any names to any answers. Data will be shared in the primary researcher's senior thesis, in journal articles, and at conferences, but this data will not include any identifying information.

Storage of Data

Anonymous electronic data will be collected and stored on the researcher's password-protected computer indefinitely. This data will be kept indefinitely in the event that the researcher or advisor wish to use it for future follow-up studies or publications. Only members of the research team will have access to the data.

Benefits

There are no perceived benefits for participants taking this survey. However, this study will help researchers better understand the relationship between meditation, mindfulness, and cognitive flexibility.

Risks or Discomforts

There are no perceived risks to participants participating in this study. Individuals may choose not to answer any questions and may quit the study at any time.

Voluntary Participation

Participation is voluntary and all individuals have the right to withdraw consent or discontinue participation at any time without penalty or prejudice from the investigator.

Compensation for Participation

Participants will receive no compensation for participation.

IRB Contact Information

For information on individual rights as a research subject, contact the following: Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070, irb@bsu.edu.

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Appendix B.

Demographics Survey

1. What is your age in years?

-17 and under

-18-24

- 25-34

- 35-44

- 45-54

- 55+

2. What is the gender with which you identify?

-Male

-Female

-Other

3. What is your Race/Ethnicity?

-White

-Black

-Asian

-Hispanic

-Native American / Pacific Islander

-Multiracial

-Other

4. What is your highest degree earned?

-High school diploma or equivalency (GED)

-Associate's degree (junior college)

-Bachelor's degree

-Master's degree

-Doctorate or Professional degree (MD, JD, DDS, etc.)

- Other specify

-None of the above (less than high school)

Appendix C.

Meditation Survey

Meditation can be defined as a mental exercise for the purpose of reaching a state of tranquility, awareness, or spiritual peace.

Have you ever meditated?

-Yes

-No

How often do you meditate?

- Never

- At least once in the last six months

- About once a month

- About once a week

- Daily

Have you ever attended a meditation class or instructional session?

- Yes

- No

Appendix D.

Freiburg Mindfulness Inventory

Instructions: The purpose of this inventory is to characterize your experience of mindfulness. Provide an answer for every statement as best you can. Please answer as honestly and spontaneously as possible. There are neither 'right' nor 'wrong' answers, nor 'good' or 'bad' responses. What is important to us is your own personal experience.

1=Rarely 2=Occasionally 3=Fairly often 4=Almost always

I am open to the experience of the present moment.	1 2 3 4
I sense my body, whether eating, cooking, cleaning or talking.	1 2 3 4
When I notice an absence of mind, I gently return to the experience of the here and now.	1 2 3 4
I am able to appreciate myself.	1 2 3 4
I pay attention to what's behind my actions.	1 2 3 4
I see my mistakes and difficulties without judging them.	1 2 3 4
I feel connected to my experience in the here-and-now.	1 2 3 4
I accept unpleasant experiences.	1 2 3 4
I am friendly to myself when things go wrong.	1 2 3 4
I watch my feelings without getting lost in them.	1 2 3 4

In difficult situations, I can pause without immediately reacting. 1 2 3 4

I experience moments of inner peace and ease, even when things get hectic and stressful. 1 2 3 4

I am impatient with myself and with others. 1 2 3 4

I am able to smile when I notice how I sometimes make life difficult. 1 2 3 4

Appendix E.

Cognitive Flexibility Scale

Instructions: The following statements deal with your beliefs and feelings about your own behavior. Read each statement and respond by choosing the number that best represents your agreement with each statement

1=Strongly Disagree 2=Disagree 3=Slightly Disagree 4=Slightly Agree 5=Agree 6=Strongly Agree

I can communicate an idea in many different ways.	1 2 3 4 5 6
I avoid new and unusual situations.	1 2 3 4 5 6
I feel like I never get to make decisions.	1 2 3 4 5 6
I can find workable solutions to seemingly unsolvable problems.	1 2 3 4 5 6
I seldom have choices when deciding how to behave.	1 2 3 4 5 6
I am willing to work at creative solutions to problems.	1 2 3 4 5 6
In any given situation, I am able to act appropriately.	1 2 3 4 5 6
My behavior is a result of conscious decisions that I make	1 2 3 4 5 6
I have many possible ways of behaving in any given situation.	1 2 3 4 5 6
I have difficulty using my knowledge on a given topic in real life situations.	1 2 3 4 5 6

I am willing to listen to consider alternatives for handling a problem.	1 2 3 4 5 6
I have the self-confidence necessary to try different ways of behaving.	1 2 3 4 5 6

Appendix F.

Recruitment Letters

Participants were recruited in the following formats:

Ball State University Communication Center

Subject: Study on Meditation, Mindfulness, and Cognitive Flexibility

Body Text: Please help me investigate the relationship between meditation, mindfulness, and cognitive flexibility. You do not need to have ever practiced meditation to take this survey! To be eligible for this study, you must be 18 years or older. This questionnaire will take about 15 minutes to complete and will be completely anonymous.

In order to participate, please click the following link:

Reddit

- /r/samplesize
- /r/meditation

Please help me investigate the relationship between meditation, mindfulness, and cognitive flexibility. You do not need to have ever practiced meditation to take this survey! To be eligible for this study, you must be 18 years or older. This questionnaire will take about 15 minutes to complete and will be completely anonymous.

In order to participate, please click the following link:

Facebook Groups

- "Meditation Matters" (11482 Members)

https://www.facebook.com/groups/270020646495756/

- "Survey Exchange – Find survey participants for empirical research studies" (4498 members)

https://www.facebook.com/groups/empirical.research.post.survey.get.responses/about/

Please help me investigate the relationship between meditation, mindfulness, and cognitive flexibility. You do not need to have ever practiced meditation to take this survey! To be eligible for this study, you must be 18 years or older. This questionnaire will take about 15 minutes to complete and will be completely anonymous.

In order to participate, please click the following link:

IRB Approval Letter

Office of Research Integrity
Institutional Review Board (IRB)
2000 University Avenue
Muncie, IN 47306-0155
Phone: 765-285-5070

DATE:	January 2, 2018
TO:	Audra Butler
FROM:	Ball State University IRB
RE:	IRB protocol # 1160780-1
TITLE:	Meditation, Mindfulness, and Cognitive Flexibility
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
DECISION DATE:	January 2, 2018
REVIEW TYPE:	EXEMPT

The Institutional Review Board reviewed your protocol on January 2, 2018 and has determined the procedures you have proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol, and you are cleared to proceed with the procedures outlined in your protocol. As an exempt study, there is no requirement for continuing review. Your protocol will remain on file with the IRB as a matter of record.

Exempt Categories:

	Category 1: Research conducted in established or commonly accepted educational settings, involving normal educations practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
XXXXX	**Category 2:** Research involving the use of educational test (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior
	Category 3: Research involving the use of educational test (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under category 2, if: (i) the human subjects are elected or appointed officials or candidates for public office; or (ii) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
	Category 4: Research involving the collection of study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

	Category 6: Research and demonstration projects which are conducted by or subject to the approval of Department or agency heads, and which are designed to study, evaluate or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in methods or levels of payment for benefits or services under these programs.
	Category 8: Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed which contains a food ingredient at or below the level and for a use found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

Editorial Notes:

1. None

While your project does not require continuing review, it is the responsibility of the P.I. (and, if applicable, faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. **Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project.** Please contact (ORI Staff) if you are unsure whether your proposed modification requires review or have any questions. Proposed modifications should be addressed in writing and submitted electronically to the IRB (http://www.bsu.edu/irb) for review. Please reference the above IRB protocol number in any communication to the IRB regarding this project.

Reminder: Even though your study is exempt from the relevant federal regulations of the Common Rule (45 CFR 46, subpart A), you and your research team are not exempt from ethical research practices and should therefore employ all protections for your participants and their data which are appropriate to your project.

D. Clark Dickin, PhD/Chair
Institutional Review Board

Christopher Mangelli, JD, MS, MEd, CIP/
Director
Office of Research Integrity